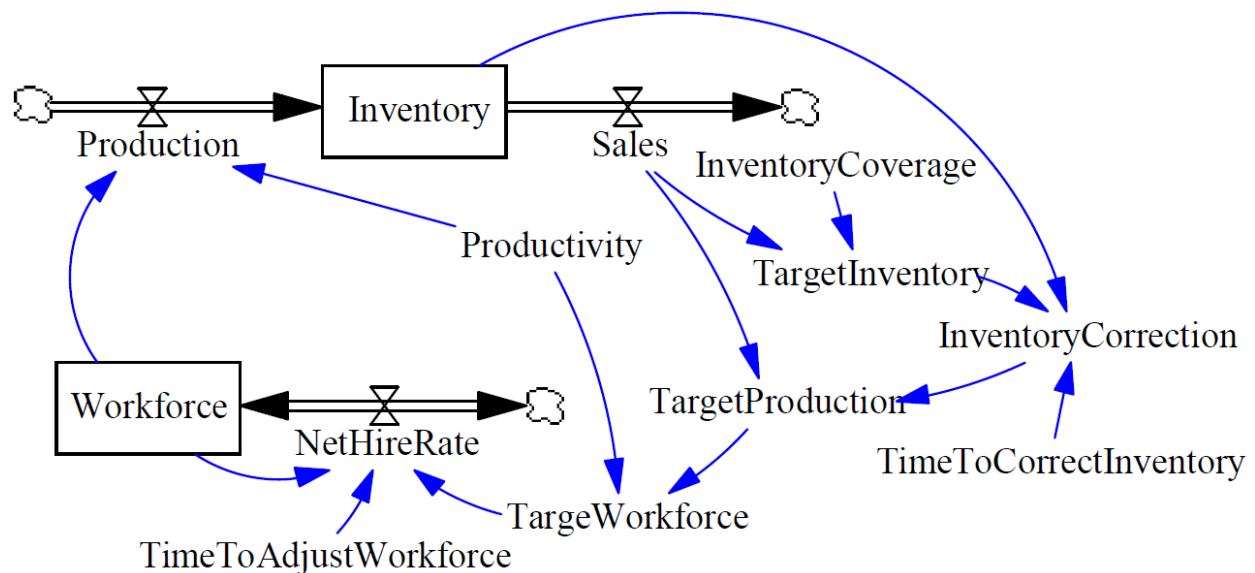


- Box/level Variables or stocks.
- Rates
- Auxiliary Variables
- Connectors

-causes tree , uses tree and feedback loops (if any **إن وجد**) for the level variables or the stocks .



3) Prey and Predator Model :

This model system consists of supplier and consumer, which lives only on this resource. For example, the supplier may be a flock قطيع of rabbits and the consumer may be a flock of foxes. Community of foxes fed on these rabbits, grows and increases whenever there is a sufficient number of rabbits. The difference equations describing the system:

The kinetic equation for rabbits:

$$r_{k+1} = r_k + g \left(1 - \frac{r_k}{500} \right) - 0.001 r_k f_k$$

The kinetic equation for foxes:

$$f_{k+1} = f_k + 0.001 r_k f_k - 0.02 f_k$$

a-Model this system using VENSIM .

b- State the causes tree, uses tree and feedback loops (if any) .

4) The Pumping Heart Model:

The human heart can be considered as a pump transported the blood from the lungs الرئة to all parts of the body. The heart can be modeled as an oscillator. Assuming that x is the length of the Muscle Fiber ليفة عضلة في القلب in the heart and v is the amount of stimulus كمية المحفز . From laboratory experiments , it has been found that the rate of the Diastole الانبساط and the Systole الانقباض of the muscle fiber increases with the amount of stimulus and decreasing proportional (by constant $\mu > 0$) with the difference between $1/3$ the fiber volume and the fiber length. It also found that the amount of stimulus decreases with the length of the fiber.

$$\frac{dx(t)}{dt} = v(t) - \mu \left[x^3(t) / 3 - x(t) \right]$$

$$\frac{dv(t)}{dt} = -x(t)$$

1) Form a Vensim model with specifying each element equation by the following values:

$$\mu = 2 \text{ cm / sec, } x(0) = 2 \text{ cm}$$

$$V(0) = 1 \text{ microgram, } t = 0 (0.1) 100 \text{ sec}$$

2) State the causes tree, uses tree and feedback loop if any .

5) Attractive Lorentz is a path form of the motor system consists of three non-linear differential equations of the first degree. The solution of these equations is a vector function of one variable, if we take this variable on the basis of the time, the solution tracks an orbit. The orbit components of two spirals and an angle between them in three dimensions. The equations are as follows :

$$\frac{d}{dt}x(t) = -ax(t) + ay(t)$$

$$\frac{d}{dt}y(t) = bx(t) - y(t) - z(t)x(t)$$

$$\frac{d}{dt}z(t) = -cz(t) + x(t)y(t)$$

Model this system using VENSIM with specifying each element equation .assume that : a,b,c,x(0),y(0),z(0)=10,28,2.67,0,0,28 respectively and dt=0.02 from 0 to 100 second.

6) Distributor of household refrigerators notices that the rate at which sells its refrigerators depends directly on the number of homes that do not have refrigerators yet and this rate is decreasing by increasing number of homes that have refrigerators. Assuming that H represents the original number of homes that do not have a refrigerator yet, but intend to possessing, and x number of homes that have a refrigerator. The difference Equation of the system is:

$$x_t = x_{t-1} + k (H - x_{t-1}).$$

Model the system using vensim with pointing موضحا the causes tree and uses tree .

*With best wishes,
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Eng. MarwaBadr*